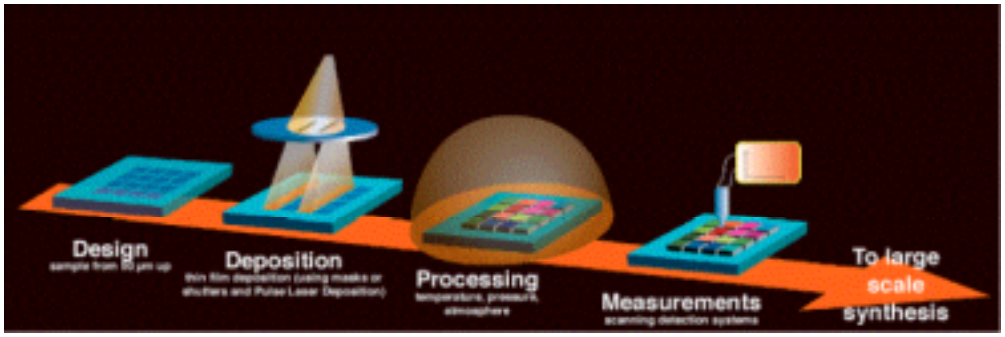
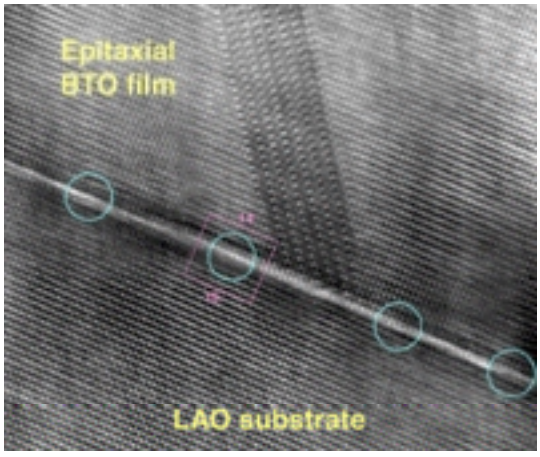
TEM studies of combinatorial libraries

- Critical Issues
  - In the search for dielectric materials for use in modern microwave communication technology, a variety of complex oxides with different chemistry and structural states are under consideration. With the ability to measure locally the relevant dielectric properties, combinatorial “libraries” are desired which are designed to either search for an optimal set of dielectric properties or study fundamentals of the relationships between crystallo-chemistry and polarization in complex oxides.
- Research Strategy
  - In a collaborative effort between NIST and the University of Maryland (Prof. I. Takeuchi), we are using transmission electron microscopy (TEM) to investigate microstructural evolution in (Ba,Sr)TiO_3 thin films fabricated from amorphous precursor multilayers consisting of TiO_2, $BaF_2/BaCO_3$, and $SrF_2/SrCO_3$. The films are deposited by pulsed laser deposition (PLD) technique on a single crystal substrate using precursor materials as a target.
- Research Highlights
  - Our preliminary results of high resolution TEM have demonstrated that rather high quality epitaxial perovskite film could be formed by the technique of amorphous precursor multilayer mixing, even with fairly low temperature anneals. The lower figure shows an example of high-resolution imaging obtained for such a BST film





$BaTiO_3$ formed via mixing of BaF_2, TiO_2 multilayers

For more information ...

Leonid Bendersky, Metallurgy Division